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Baubree has produced artificially one variety (lherzolite) by dry fusion, but this appears to be the first clear case of a peridotite volcano with peridotite ash.

Perhaps an analogous case is in Elliot county, Kentucky, where Mr. J. S. Diller has recently described an eruptive peridotite which contains the same accessory minerals as the peridotite of Kimberley, and also penetrates and encloses fragments of carboniferous shale, thus suggesting interesting possibilities.

H. CARVILL LEWIS.

The eccentricity theory of the glacial period.

I desire to add a supplementary note to my letter of Aug. 16, published in the issue of *Science* for Aug. 27.

In that letter I called attention to the contrast between the northern and the southern hemisphere in respect of glaciation, as tending to show, that, other things being equal, a climate of means (mild winters and cool summers) is more favorable to the accumulation of snow and ice than a climate of extremes (cold winters and hot summers). The bearing of this proposition upon the eccentricity theory is pointed out in my letter.

I now wish to call attention to another well-known geographical fact, which seems to confirm the conclusion that glaciation is favored by a climate of means rather than by a climate of extremes. I refer to the altitude of the snow-line in torrid, temperate, and frigid zones respectively. At the equator the snow-line falls below the annual isothermal plane of 32° F.; while, as we recede from the equator, the snow-line rises above the plane of 32° . So far does the snow-line rise above the isothermal plane of 32° , as we go polewards, that, while the latter plane reaches the sea-level not far from 60° latitude, it has been doubted whether in the northern hemisphere the snow-line anywhere reaches the level of the sea. According to J. D. Forbes, "the mean temperature at the snow-line near the equator is 34.7° ; in the temperate zone it is 25.3° ; in the arctic regions, about 21° " (Johnston, *Physical atlas of natural phenomena*, Edinburgh and London, 1856, p. 33). While all such numerical statements of the temperature of the snow-line in different latitudes can be considered only rough approximations, there can be no doubt of the general law that (apart from local abnormalities) the temperature of the snow-line falls as we go from the equator towards the poles. Now, it is also true that the annual range of temperature increases from the equator to the poles. At the snow-line near the equator, the extreme summer temperature is but little above the freezing-point; while at the snow-line in the arctic regions, though the mean temperature for the year falls several degrees below freezing point, the extreme summer temperature rises far above it. The comparison of the zones of climate leads, accordingly, to the same conclusion as the comparison of the northern and southern hemispheres. The existence of perpetual snow is shown by both comparisons to depend less upon cold winters than upon cool summers.

A very simple *a priori* consideration suggests the probability of the same conclusion which we have drawn from geographical facts. It seems probable, *a priori*, that extreme winter cold cannot greatly increase the amount of snow-fall. So long as the temperature of any place keeps below 32° , the precipitation will be all in the form of snow; and this

will be the case when the temperature is but little below 32° , as truly as when it falls far below zero.

Cooling a mass of air from 32° to a lower temperature can produce but little additional precipitation, since the maximum vapor tension at 32° is very little, and the change of maximum vapor tension corresponding to changes of temperature in the lower part of the thermometric scale is very slight. The influx of warm and moist air bearing supplies of vapor is not favored by extreme winter cold, since such extreme cold tends to increase barometric pressure over the area affected. On the other hand, every degree that the summer temperature rises above 32° shows an effective increment of the melting-power of the summer sun. The inference would seem to be justified, that, in any place where the annual mean temperature is below or not much above 32° , the more nearly the extreme summer and winter temperatures approach the annual mean, the greater will be the tendency (other things being equal) to the accumulation of perpetual snow. This *a priori* inference seems to be in exact accord with the geographical facts referred to in this and in my former letter.

WILLIAM NORTH RICE.

Wesleyan university, Oct. 8.

The theory of utility.

In connection with the suggestive article in *Science* of Oct. 1, on 'Launhardt's Mathematical economics,' I would like to offer a new theory of utility, or, rather, to discuss it from a new standpoint, and indicate what I consider to be the error in Jevons's main premise.

Utility, or usefulness, is the satisfying of desires. Desires are always in the present, though many, perhaps the most of them, have a prospective nature. Usefulness is not the capacity or capability of being useful: it is the state or quality of *being* useful. It involves, not a possible, but an actual satisfying of desires: e.g., on a certain day a loaf of bread would have possessed utility for Robinson Crusoe in satisfying his hunger; a second loaf would have possessed utility, not in satisfying the hunger of the morrow, but in satisfying his desire to have the possible wants of the future provided for.

If utility be defined as a capacity to serve man or to satisfy his desires, and by this is meant something quite different from the actual satisfying, it serves no purpose of distinction, for with this definition, when affirming utility to be an attribute of any thing, we must always add, 'under certain circumstances'; and there is probably not a thing in existence but what, under certain circumstances, possesses this capacity.

The confusion prevailing as to the nature of utility has arisen from the fact, that, in discussions upon the subject, the provident trait in man's character has been entirely neglected; for from this trait spring desires which are, indeed, of a prospective nature, but whose satisfaction involves utility as indubitably as does the satisfaction of his physical needs.

Utility being of the present moment, time is not one of its dimensions, as the theory of 'final degree of utility' necessarily presupposes. When Jevons ('Theory of political economy,' p. 51) declares that "utility may be treated as a *quantity of two dimensions*, — one dimension consisting in the quantity, and another in the intensity of the effect produced upon the consumer," — it is clear that the supposed dimension of quantity does not have reference to the